

Primary Bladder Neck Obstruction in Men and Women

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Primary bladder neck obstruction (PBNO) is a condition in which the bladder neck does not open appropriately or completely during voiding. Although the true prevalence of PBNO is difficult to ascertain, studies in both men and women with voiding dysfunction demonstrate a marked prevalence of the condition. Symptoms caused by PBNO include storage symptoms (frequency, urgency, urge incontinence, nocturia) and voiding symptoms (decreased force of stream, hesitancy, incomplete emptying). There are multiple theories as to the etiology of PBNO, including muscular and neurologic dysfunction and fibrosis. The diagnosis of PBNO can be made precisely with videourodynamics, urodynamic testing with simultaneous pressure-flow measurement, and visualization of the bladder neck during voiding. Treatments vary from watchful waiting to medical therapy to surgery, depending on the severity of symptoms, urodynamic findings, and response to therapy. This article reviews the current state of the art with respect to the prevalence, etiology, diagnosis, and treatment of PBNO. [Rev Urol. 2005;7(suppl 8):S12-S17]

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Pprimary bladder neck obstruction (PBNO) is a condition in which the bladder neck fails to open adequately during voiding, resulting in increased striated sphincter activity or obstruction of urinary flow in the absence of another anatomic obstruction, such as that caused by benign prostatic enlargement in men or genitourinary prolapse in women. PBNO was first described in men by Marion in 1933.¹ Later, in 1973, Turner-Warwick and colleagues² advocated the use of urodynamics and voiding cystourethrography to diagnose bladder neck dysfunction in men aged 50 years or younger with a long history of lower urinary

tract symptoms (LUTS). Similarly, Norlen and Blaivas³ in 1986 diagnosed vesical neck obstruction in 23 young and middle-aged men with prior diagnoses of prostatitis, neurogenic bladder, and psychogenic voiding dysfunction. PBNO was reported as a clinical entity in women in 1984 by Diokno and colleagues⁴ and by Axelrod and Blaivas⁵ in 1987—each group describing the condition in 3 women.

Etiology

The precise cause of PBNO has not been clearly elucidated. Theories as to the etiology of the condition are varied. Initial theories focused on structural changes at the bladder neck, such as a fibrous narrowing or hyperplasia, as initially proposed by Marion.¹ Leadbetter and Leadbetter⁶ proposed that there is a fault of dissolution of mesenchyme at the bladder neck or inclusion of abnormal amounts of nonmuscular connective tissue, resulting in hypertrophic smooth muscle, fibrous contractures, and inflammatory changes. Similarly, Turner-Warwick and colleagues² described inefficient bladder neck opening resulting from abnormal morphologic arrangement of the detrusor/trigonal musculature.

A neurologic etiology for PBNO in the form of sympathetic nervous system dysfunction has also been suggested.⁷ Crowe and colleagues⁸ demonstrated an increase in the density of neuropeptide Y-immunoreactive nerves, part of the sympathetic contractile system of the bladder neck, in bladder neck tissue obtained from men with bladder neck dyssynergia.

Some cases of apparent bladder neck dysfunction may actually be the result of abnormalities of the striated urethral sphincter. It is widely accepted that the first event in volitional micturition is relaxation of the external striated sphincter.⁹⁻¹¹ The recent

work of Yalla and Resnick¹¹ showed that, as the external sphincter relaxes (and pressure drops), the pressure in the bladder and at the bladder neck increases. However, the rate of increased pressure in the bladder is greater than that at the bladder neck. When vesical pressure exceeds vesical neck pressure, which occurs “within a few seconds,” voiding ensues. The

study of 84 Taiwanese men younger than 55 years referred for chronic voiding dysfunction and an obstructive uroflow pattern, Yang and colleagues¹⁵ reported a 33% incidence of PBNO.

Data on the incidence and prevalence of PBNO in the female population are scant. Most reports on the entity in women include only a few

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authors also found that, in certain patients, the periurethral striated muscle can extend functionally to the bladder neck. In such patients, the pressure changes during the initiation of voiding may be slightly altered. In another study, Yalla and colleagues¹² demonstrated that such extension of the functional external sphincter to the bladder neck occurred in 48% of men.

Incidence and Prevalence

The true prevalence of PBNO in the male and female populations is not known. Unfortunately, the best epidemiologic data available are based on incidence rates in specific populations and not the general population. More of such data are available for men than for women. In addition, the studies that have been conducted have excluded older men, to avoid the possible contribution of benign prostatic hyperplasia (BPH).

In a retrospective review of 137 men aged 50 years or younger with chronic voiding dysfunction and abnormal urodynamics, Kaplan and colleagues¹³ reported a 54% incidence of PBNO. In a prospective study of 85 men aged 18 to 45 years with LUTS who agreed to urodynamic evaluation, Nitti and colleagues¹⁴ found a 47% incidence of PBNO. Finally, in a

cases. A study of urodynamic findings in a large cohort of women with LUTS of varying types found a 4.6% incidence of PBNO.¹⁶

Presentation and Diagnosis

Presentation

PBNO may present with a variety of symptoms, including voiding symptoms (decreased force of stream, hesitancy, intermittent stream, incomplete emptying), storage symptoms (frequency, urgency, urge incontinence, nocturia), or a combination of both.^{14,17} In some cases, the initial presentation may be urinary retention. Pain can accompany LUTS, and PBNO has been misdiagnosed as prostatitis in men.¹⁷ Women present with symptoms similar to those of men,^{4,5,18-20} although some series describe a higher prevalence of elevated postvoid residual urine volume (PVR) and chronic urinary retention in women.¹⁸⁻²⁰

In order to determine how presenting symptoms differ between men and women, our team at New York University compared 2 cohorts of patients with PBNO: 37 men selected from a prospective database of 50 young men (aged 18-45 years) with voiding dysfunction who underwent videourodynamics (VUDS) and 20 women from a prospective database of 328 women who underwent

VUDS for LUTS. The mean age of the men was 36 years; the mean age of the women was 48 years. The mean durations of symptoms for men and women were 67 months and 58 months, respectively. Symptoms were compared using the American Urological Association (AUA) Symptom Index categorized into total, voiding, and storage scores. The mean total, storage, and voiding scores for men versus women were 18.4 versus 18.7 ($P = .905$), 7.8 versus 7.4 ($P = .760$), and 10.6 versus 11.3 ($P = .639$), respectively. Pelvic pain of some sort was experienced by 46% of men and 15% of women.

Presenting symptoms appear to be similar in men and women, with a combination of voiding and storage symptoms being common. In our study, men had a higher incidence of pelvic pain.

Diagnosis

PBNO is a videourodynamic diagnosis, the hallmark of which is relative high-pressure, low-flow voiding with radiographic evidence of obstruction at the bladder neck with relaxation of the striated sphincter and no evidence of distal obstruction. In men, what constitutes high pressure and low flow in PBNO has not been universally defined. In various series on PBNO, detrusor pressure at maximum flow ranges from 20 cm H₂O to 70 cm H₂O with maximum flow rates (Q_{max}) of less than 15 mL/s.^{3,15,17} Nomograms used to classify obstruction in men with BPH do not necessarily apply to PBNO.

Nitti and colleagues¹⁴ recently categorized PBNO into 3 distinct types: classic high-pressure, low-flow voiding (Figure 1); normal-pressure, low-flow voiding, with narrowing at the bladder neck (Figure 2); and delayed opening of the bladder neck.

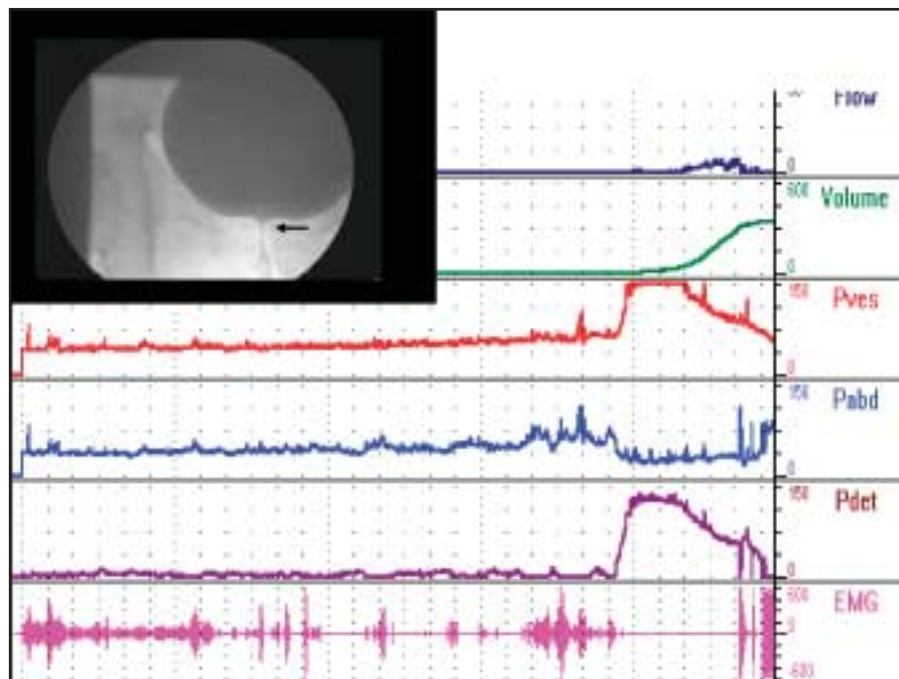


Figure 1. Primary bladder neck obstruction in a 45-year-old man with lower urinary tract symptoms refractory to medical therapy: This represents classic high-pressure, low-flow voiding dynamics with obstruction at the bladder neck, which does not open normally during voiding (arrow). Pves, vesical pressure; Pabd, abdominal pressure; Pdet, detrusor pressure; EMG, electromyogram.

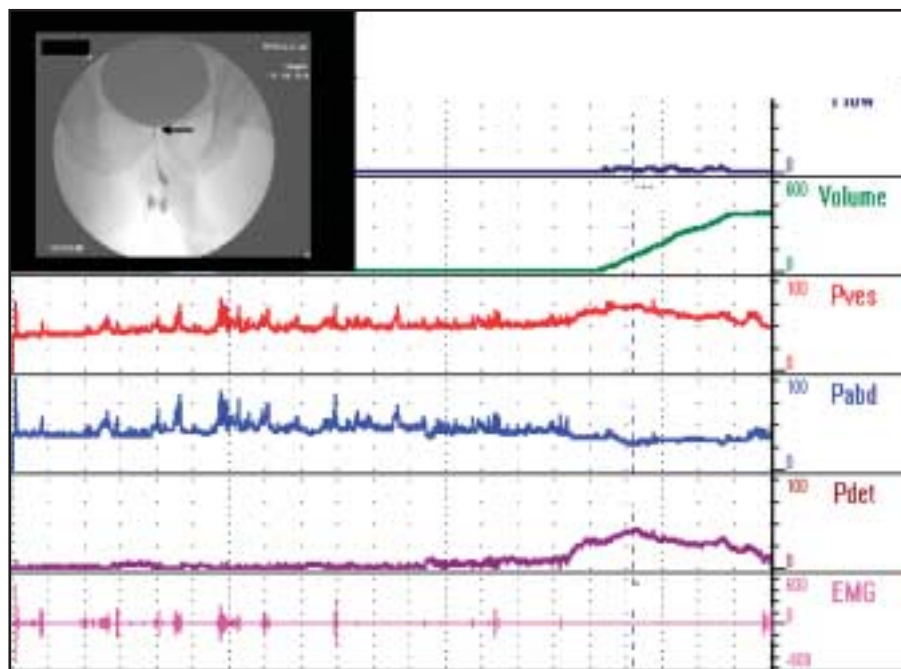


Figure 2. Bladder neck dysfunction in a 37-year-old man with years of lower urinary tract symptoms refractory to conservative therapies: In this case, there are normal-pressure, low-flow voiding dynamics with poor opening of the bladder neck during voiding (arrow). Pves, vesical pressure; Pabd, abdominal pressure; Pdet, detrusor pressure; EMG, electromyogram.

Alternatively, PBNO has been diagnosed by micturitional urethral pressure profile, in which a pressure drop between detrusor pressure and bladder neck pressure is seen.²¹

In women, the pressure/flow criteria for PBNO are even less defined. According to the videourodynamic criteria proposed by Nitti and colleagues,¹⁶ a detrusor contraction of any magnitude associated with radiographic evidence of obstruction at the bladder neck is adequate to diagnose PBNO. Chassange and colleagues²² proposed cut points for obstruction of 15 mL/s or less for Q_{\max} and greater than 20 cm H₂O for detrusor pressure at maximum flow. The Blaivas-Groutz nomogram has also been proposed to diagnose obstruction.²³ However, if either of the latter 2 methods is used, a simultaneous radiographic study is still needed to localize the obstruction and make a definitive diagnosis (Figure 3).

Our team at New York University compared urodynamic findings in men and women with PBNO using the 2 groups described above. Flow parameters were similar, with a mean Q_{\max} of 10.6 mL/s for men and 8.0 mL/s for women ($P = .101$). However, detrusor pressure at maxi-



Figure 3. Primary bladder neck obstruction in a 35-year-old woman with obstructive voiding symptoms and intermittent urinary retention: Note the failure of the bladder neck to open at all, despite a detrusor contraction of greater than 60 cm H₂O. pves, vesical pressure; pabd, abdominal pressure; pdet, detrusor pressure.

patients who are not bothered much by their symptoms and have no clinical or urodynamic evidence of upper and/or lower urinary tract decompensation. Unfortunately, the natural history of PBNO is not well characterized. It is not known how many men or women who elect watchful waiting have progressive symptoms, develop decompensation, or subse-

“expert opinion,” with only a few small series available for review.

Pharmacotherapy

α -Blockers have been the mainstay of pharmacotherapy for PBNO. Although much of their effect is presumed to involve the smooth muscle of the bladder neck, α -blockers may also affect the bladder via local or central mechanisms, as is assumed to be the case in BPH treatment. However, unlike α -blocker therapy for BPH, only variable success has been reported for α -blocker therapy for PBNO. Most studies have been small, nonrandomized, and noncontrolled, with no consistency in type or dosage of drug. In addition, there are no reported placebo-controlled studies, and outcomes have been variable. Most studies report subjective results, with relative underdosing of medication, and no parameters have been consistently reported to predict success or failure.

In 1994, Kaplan and colleagues¹⁷ reported failure of α -blockade in 31

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imum flow was significantly higher in men than in women: 52.5 cm H₂O versus 38.5 cm H₂O ($P = .027$). PVR was significantly higher in women: 180 mL versus 33 mL ($P < .001$).

Treatment of PBNO

The treatment options for men and women with PBNO are the same and include watchful waiting, pharmacotherapy, and surgical intervention. Watchful waiting is an option for

quently receive treatment. It is likely that, in some cases, older men with LUTS presumed to be caused by BPH who had the start of symptoms in their twenties or thirties actually have long-standing PBNO.

A review of the literature provides some reasonable guidelines for the treatment of PBNO in men, albeit without the benefit of randomized, controlled trials. For women, however, most treatment options are based on

men who ultimately underwent surgical intervention. Relatively low dosages of terazosin (5 mg/d) or doxazosin (4 mg/d) were used. In the series by Trockman and colleagues,²⁴ 30% of men beginning treatment with an α -blocker—prazosin, 2 mg twice daily, or terazosin, 2 mg daily—continued the medication long term. For the patients who continued α -blocker therapy, AUA symptom scores improved 67%.

Recently, Nitti and colleagues¹⁴ reported that 10 (58%) of 17 men with PBNO had significant improve-

than did nonresponders. Treatment was more likely to be successful in patients who were urodynamically obstructed.

It appears that α -blockers have a urodynamic effect on PBNO in men. Terazosin has been shown to increase bladder neck diameter and raise hydraulic pressure in the membranous urethra in men with PBNO.²⁴ The drug had no effect on these parameters in healthy control subjects. Although the control subjects had significantly larger bladder neck diameters and higher membranous

phenoxybenzamine, prazosin, or terazosin. Subjects were highly symptomatic, and all had a significantly elevated PVR. PBNO was diagnosed using stringent urodynamic criteria. Fifty percent of subjects responded to α -blockade with decreased symptoms, increased flow, and decreased PVR. Specifically, in responders, Q_{\max} increased from 9.5 mL/s to 15.1 mL/s and PVR decreased from 277 mL to 27 mL. No validated symptom assessment was used to evaluate symptom response.

Surgery

PBNO can be treated surgically with unilateral or bilateral transurethral incision of the bladder neck. The main concern with bladder neck incision is the development of postoperative retrograde ejaculation. Retrograde ejaculation is less likely to occur with unilateral incision as opposed to bilateral incision.^{17,24}

Bladder neck incision is highly effective. In 1986, Norlen and Blaivas³ performed incision or resection in 18 of 23 men with PBNO. All patients experienced “symptomatic relief” (no objective parameters were used), and mean Q_{\max} increased from 9.1 mL/s to 26.1 mL/s. In 1994, Kaplan and colleagues¹⁷ reported the results of unilateral incision in 31 men. Thirty

ment in AUA symptom score with α -blocker therapy; however, only 4 (24%) patients continued therapy for longer than 1 year. Finally, in a study by Yang and colleagues,¹⁵ 24 Taiwanese men with PBNO received doxazosin, 1 mg to 2 mg daily. Fifty-eight percent of subjects had a reduction in International Prostate Symptom Score (IPSS) of greater than 50%. The researchers also noted that men with positive responses had higher mean detrusor pressures at maximum flow and lower mean Q_{\max}

urethra hydraulic pressures before treatment, posttreatment values in PBNO patients were similar to those of control subjects.²⁵

The treatment of PBNO in women, including pharmacologic treatment, is based primarily on expert opinion. Most opinion leaders recommend α -blocker therapy, but this is based primarily on anecdotal experience. There is one published study, by Kumar and colleagues,²⁰ in which 24 women with PBNO received initial treatment with an α -blocker, namely,

The main concern with bladder neck incision is the development of postoperative retrograde ejaculation.

Main Points

- Primary bladder neck obstruction (PBNO) is a condition in which the bladder neck fails to open adequately during voiding, resulting in increased striated sphincter activity or obstruction of urinary flow in the absence of another anatomic obstruction.
- PBNO can present with a variety of symptoms, including voiding symptoms (decreased force of stream, hesitancy, intermittent stream, incomplete emptying), storage symptoms (frequency, urgency, urge incontinence, nocturia), or a combination of both.
- PBNO is a videourodynamic diagnosis, the hallmark of which is relative high-pressure, low-flow voiding with radiographic evidence of obstruction at the bladder neck with relaxation of the striated sphincter and no evidence of distal obstruction.
- α -Blockers have been the mainstay of pharmacotherapy for PBNO. Although much of their effect is presumed to involve the smooth muscle of the bladder neck, α -blockers may also affect the bladder via local or central mechanisms.
- PBNO can be treated surgically with unilateral or bilateral transurethral incision of the bladder neck.
- Uniform diagnostic criteria for PBNO need to be developed to help predict response to treatments. Better noninvasive diagnostic criteria to identify patients who are candidates for further testing would be helpful. Randomized, placebo-controlled studies with appropriate dose titration and defined outcome measures are required.

men experienced a subjective improvement in symptoms, with mean Boyarsky symptom score decreasing from 16.4 to 6.4 and mean Q_{\max} increasing from 9.2 mL/s to 15.7 mL/s. No retrograde ejaculation was reported in this series with unilateral incision.

Unilateral bladder neck incision was also performed by Kochakarn and Lertsithichai²⁶ in 35 men aged 36 to 46 years. Objective outcomes were measured with respect to IPSS, flow rate, and sperm count. Patients were evaluated at 3, 6, and 12 months postsurgery. Of note, there was continued improvement in IPSS and flow rates up to 1 year after surgery. At 1 year, there was a mean 55% decrease in IPSS and a mean 95% increase in flow rate. Postoperative sperm counts were decreased at 6 to 12 months (70% mean decrease from preoperative); however, the authors could not offer a satisfactory explanation for this decrease, because it did not appear to be related to ejaculatory volume. In a study by Trockman and colleagues,²⁴ 18 of 36 men diagnosed with PBNO underwent bilateral incision. A "successful" outcome was obtained in 16 (89%) of the men. Mean AUA symptom score decreased from 17.1 to 4.3, and mean Q_{\max} increased from 8.2 mL/s to 26.7 mL/s. Antegrade ejaculation was maintained in 73% of subjects.

Bladder neck incision and resection may also be used to treat PBNO in women. Axelrod and Blaivas⁵ performed bilateral incisions at 5 o'clock and 7 o'clock in 3 women with PBNO and reported success in all cases, with no subject developing incontinence. Gronbaek and colleagues¹⁹ performed a single incision initially and a second incision as needed in 38 women with PBNO. At a mean follow-up of 55 months, the success rate was 76%. One patient (3%) developed incontinence. Kumar and colleagues²⁰ performed a single incision at 12 o'clock

using a pediatric resectoscope in 6 women with PBNO who had failed α -blockade. Success was reported in all 6 subjects, with Q_{\max} increasing from 8.5 mL/s to 15.5 mL/s and PVR decreasing from 256 mL to 40 mL. Mild stress urinary incontinence was reported in 2 (33%) of the women.

Future Perspectives

There is still much to learn about the natural history and etiology of PBNO in both men and women. The exact causes of this condition need to be determined, and more information is needed regarding treatment with respect to symptom progression and risk of developing urinary retention or renal insufficiency. These are difficult tasks given the relatively low prevalence of the disorder and reluctance of some patients to undergo surgery that could provide a tissue specimen.

In the meantime, it is important that uniform diagnostic criteria be developed to help predict response to treatment. Better noninvasive diagnostic criteria would be helpful, at least to identify patients who are candidates for further testing. Quality studies of PBNO have been scarce to nonexistent. In order to truly assess the effects of therapy, particularly pharmacotherapy and minimally invasive treatments, randomized, placebo-controlled studies with appropriate dose titration and defined outcome measures are necessary. ■

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